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# FOREST CONTROL

*by*

# CONTINUOUS INVENTORY

"Today I have grown taller from walking with the trees."

...Karle Wilson

Milwaukee, Wis. May, 1959 No. 62

## ARBOR DAY, 1959

Ed Lowe's young wife is planting trees,  
In flaunting skirt and daring breeze.  
Ten years before her hopes were high,  
She farmed the earth, lived in the sky.

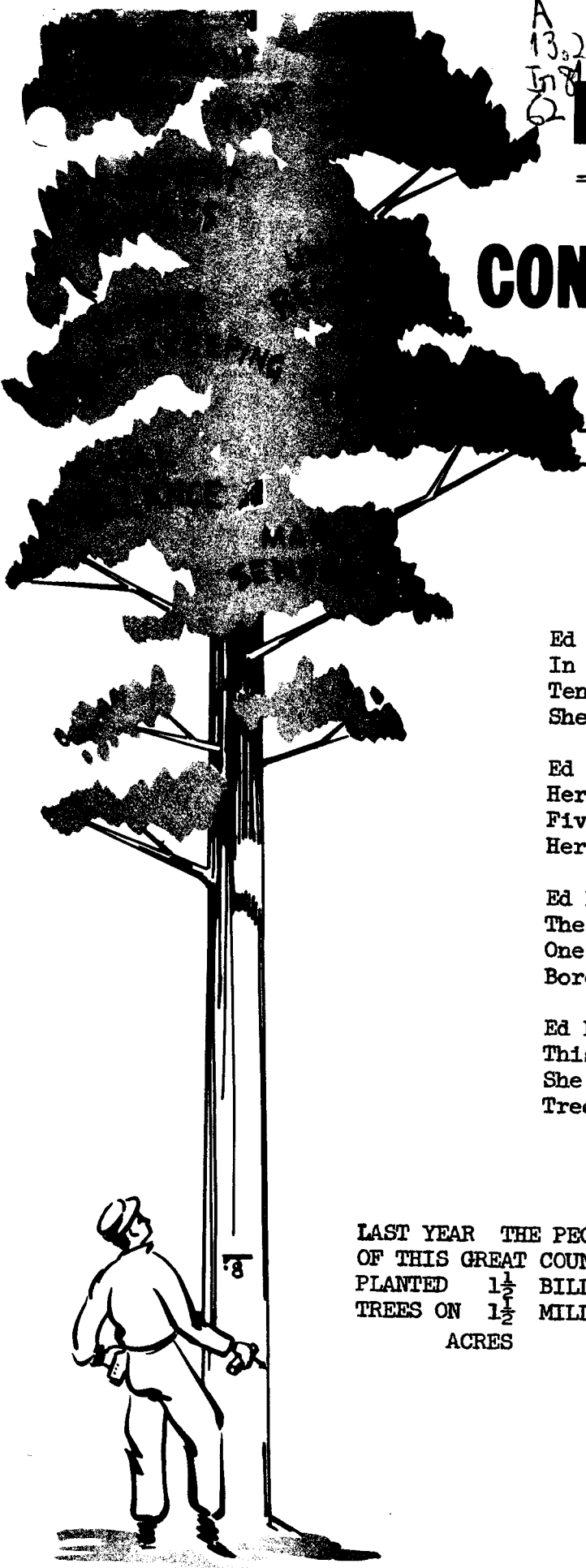
Ed Lowe's frail wife tamps trees in dust,  
Her hair blows wild, slave of each gust.  
Five years before, still fair to see,  
Her fields grew more than six for three.

Ed Lowe's tired wife looks into space,  
The light of life dims in her face.  
One year before her failing fields  
Bore one for four, greed's scanty yields.

Ed Lowe's proud wife walks in the sun,  
This crop will grow, time's sands will run.  
She looks ahead, her dreams are good,  
Trees can be bread, poor soils grow wood.

LAST YEAR THE PEOPLE  
OF THIS GREAT COUNTRY  
PLANTED 1½ BILLION  
TREES ON 1½ MILLION  
ACRES

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EXCERPT FROM PANEL AT FIRST ANNUAL MEETING

WASHINGTON SECTION OF SAF

February 19, 1959

Washington, D.C.

Industrial CFI - What It Is, What It Does, and  
How It Does It

By Calvin B. Stott, State and Private Forestry,  
R-9, U.S.F.S.



## Industrial CFI

### What It Is, What It Does, and How It Does It

by Calvin B. Stott  
State and Private Forestry, R-9, U.S.F.S.

#### Foundations

CFI means continuous forest inventory.

Continuous forest inventory in the broadest sense, is nothing more than a frequently repeated, directly comparable measurement of trees in systematically placed sample plots of fixed location.

CFI plots are established to secure forest management information important to the continuous growth of high value timber products in fully stocked stands.

There are only three new features in CFI; frequent inventory, direct comparison and identical or fixed plot locations for every remeasurement. These three features have been of great interest to the forest industries in the Lake States and they are the backbone of the method in Region Nine.

The most important current or immediate purpose of CFI on industrial forest land is to provide fresh, complete, tested facts about the forest, so that needed management reforms may be expeditiously initiated and accomplished. Using most of the best old and new tools of the professional forester, CFI screens out the major forest problems for prompt solution through the concerted action of every facet of the industrial organization.

#### Encouragement

Encouragement in the work of continuous forest inventory has been given by the United States Forest Service in Region Nine, in the Division of State and Private Forestry where the search for better methods of collecting and handling timber inventory records has been in progress for 25 years. Our job since 1934 has been geared, with some success, to cooperation through work and services freely given. It has been an action program from the beginning, and a most demanding job, with strong emphasis on woods work. The duties and responsibilities have been numerous and varied, embracing almost every field of professional forestry.

Uncommon procedures are often uncommonly troublesome to initiate and establish. CFI has been no exception to this rule. It has been arduous but interesting work made doubly difficult by early indifference, discouragement, resistance, and the fact that the work does not show directly on the ledger of public forestry accomplishments.

Only hard work, sound knowledge, honest intention and time will build back on industrial forest lands the high value growing stock they once supported. CFI demands hard work, but it offers in exchange a ready and lively understanding of the forest, and so it has become an important part of industrial planning for woodland betterment.

## Broad Accomplishments

The earliest assignments in cooperative forest inventory were temporary plot cruises of the lands of large timber companies. Among these was the Goodman Lumber Company of northern Wisconsin. Here, in 1937, the first five circular growth plots were established to demonstrate improved techniques. This work was made necessary because the original growth plots established by the company ten years before did not give reliable information. They failed the remeasurement test.

In the course of this task, a circular plot tally sheet for locating and recording the trees was developed by Edward Ryan, an assistant technician working with the field crews. Ryan's technique, which does not require paint numbering trees, was used in the spring of 1938 to set out 140 growth plots on selectively cut land of the Ford Motor Company in northern Michigan. These plots were successfully remeasured and directly compared by the Michigan Tech Ford Forestry Center in 1958, 20 years after their establishment.

About 1939 Dr. O. D. Diller of the Ohio Agricultural Experiment Station conceived of the use of a  $\frac{1}{4}$  pint Super Eagle oiler gun No. 66 for paint numbering trees. Instantly successful, this method was used henceforth in the north, and the circular plot tally sheet was discontinued. During the past few years, 2,100 plots of 60,000 paint numbered trees have been remeasured with fruitful results, to provide the assurance needed for a continuation of the method.

The records now show that in the past 21 years, 17,000 permanent CFI plots have been set out on 6 million acres in the north central region. I do not know the number of CFI cases throughout the United States, but a half million trees marked on individual tree cards in Region Nine alone attest to the practicability of the method.

## Industrial Application of the Results of CFI.

CFI has been used in the Lake States for the construction of management plans, cutting budgets, silvicultural work improvement programs and broad timber operating schedules. It is providing reliable growth and mortality data and will eventually measure the logging drain from the whole forest area with reasonable accuracy. The woods run plots have encouraged soils, insect and disease studies, provided the incentive for the construction of comprehensive road plans and they have increased the utilization of inferior species and defective trees. CFI has resulted in deliberate changes in cutting progression, ~~encouraged~~ partial cutting and increased the harvest of mortality and potential mortality materials.

Every reinventory offers new ways of projecting forward current information. Trends are strengthened, accuracy is improved and in each case the time needed to come to an understanding of the problems of the forest is reduced.

## The Plots

CFI plots are one-fifth or one-seventh acre in size and a two-man crew establishes them at the rate of two or three plots per day. Distribution of

the circular samples is methodical and systematic. They are spotted on the field location map from an overlay grid without regard to preliminary stratification of forest cover, ownership or convenience of location. More than half of the establishment time is spent in travel to and from the plot stations.

The plot job requires six months of woods work and two weeks on the data processing machines at five-year intervals, for areas approximating a quarter million acres in size. The cost of CFI, including field work and data processing, ranges between 25 and 35 dollars per plot.

Each plot is coded in the card for ecological, economic, administrative and operational area breakdowns. Because of the mechanical arrangement of the samples in rectilinear pattern, plot volumes and plot areas are directly related. There is a constant volume expansion ratio for the whole forest or for any part of it. This is not the case with stratified sampling.

Long experience over wide expanses of the northern forest has given us a sound impression of the coefficients of variation of the cover classes encountered. As a result, the percent of sample has also become fairly constant for large areas. It is common practice to take two samples per section. Tested results show that pulpwood cover classes of major importance are adequately sampled at this rate.

### The Trees

All trees 5 inches and larger are distinctly paint marked at DBH, and paint numbered. Plot centers are clearly witnessed with 4 paint marked trees and no attempt is made to hide the plots in any way. Instead, close supervision of the cutting operation guarantees a uniform treatment of the stands in and outside of the sample plots. Specific plot numbers within annual cutting allotments are sent to each district forester with responsibilities and directions for uniform cutting standards clearly indicated.

Trees in the plots are measured, classified and mark sensed or port-a-punched on cards at an average rate of two and one-half minutes each. This does not include travel time outside of the plot. Each tree is described and measured to tenth inch diameter and two foot length intervals, and calculated in board feet, cords, cubic feet or basal area. The flexibility of these kinds of data offer an almost unlimited opportunity for long range correlation studies in every phase of forestry and industrial planning.

### The Importance of CFI

CFI is important to the industrial plant. It is industry's application of automation to the woods, and from the woods it brings an endless flow of advice on long range timber resource planning. CFI goes beyond the limited confines of special research studies to measure and record changes in trees and forest cover on a representative, forest-wide basis.

Every five years continuous forest inventory sets a new production goal for the forest. The impact of the immense task of gathering, machine compiling and analyzing these data is felt in every level of the industrial organization and it is both impressive and educational to complete an inventory control project. Industrial management has been the first to recognize this extra curricular benefit.

For efficient plant operation, the constantly shifting market and the ever changing forest universe must both be subjected to repeated and critical scientific review. This review, for the forests of the north central region, is best handled by the application of inventory controls with complete data processing.

CFI is important to the executive staff in the front office.

It provides top management with the facts from which sound workable high level policy decisions are made. With CFI it is not necessary to improvise on the basis of incomplete information nor are the results secured too late for executive action. The system offers a thorough controlling knowledge of the forest to those responsible for its efficient treatment, eliminating management by hunches and guesses, and substituting instead realistic supporting facts and figures of current accuracy. CFI replaces theoretic opinion with tested fact.

CFI is important in industrial accounting. Because it is a direct bookkeeping system for the woods, accountants accept CFI with its related concept of sustained yield management. CFI fills many of the demands of accounting. It is a continuing trial balance of woods conditions, an essential audit of the condition and quantity of trees growing in the forest, and a sound method of checking the debit and credit entries in the forest account.

In the past the timber cruiser took a long time to complete what we call today a one-shot cruise. Generally 20 to 30 years passed before he struck a new timber balance, sometimes to find serious depletion due to over-cutting, but more often to discover a saturated woods capital of declining vigor and high risk. Either of these situations cause losses which CFI can reduce or even eliminate, if inventories are kept current and the findings are accepted and put into effect. The one-shot cruise was hardly good enough for the unmanaged forest of the past, but for the managed forest of the present it is completely inadequate.

Today industrial accountants are taking the record of wood on hand in the forest from the CFI ledgers to establish timber depletion rates, to simplify problems of taxation, to determine the valuation of the forest, and to help settle problems of supply and demand currently and for the years ahead. The continuous timber inventory records of the forester have finally become useful and trusted tools of the industrial accountant and business manager.

CFI is important to the forester. It is the first step in the establishment of stability and continuity of forest management, after adequate protection and transportation are assured. A gradual outgrowth of many years of Forest

Service assistance, CFI has nevertheless been developed essentially by industrial foresters. It stems fundamentally from the desire of the owner to know at all times what he has in the woods. This information, machine grouped by common tree and area classes, is provided frequently enough to measure natural and induced trends over wide forest areas.

### Essential Requirements for Successful CFI

CFI is helpful if it is accurately done. It can only cause discouragement and disillusion if poor work prevails in the woods and on the machines. Long experience enables us to list the most important qualifications for a good job. The organization seeking to establish a system of inventory controls on large forest properties will do well to stand firmly behind these 13 essential requirements.

1. Seek the advice of the most experienced CFI and machine technicians.
2. Assign one man complete responsibility for the entire job, and give him time to handle it.
3. Take time for group planning all field and machine steps. Flow charts and machine plans are essential preliminary tasks. They should be completed before plot work begins.
4. Make sure that top management is backing the job. It is unwise to initiate the work without this support. CFI is a concept of many minds.
5. Do not high pressure the woods or machine crews. Be slow, sure and careful.
6. Learn the most efficient method of plot installation and require its use by all crews. Generally there is only one effective plot taking technique.
7. CFI plots are not accurately established without demonstration, training, supervision and check.
8. Do not involve your field or machine work with procedures important to hand computing methods but not essential to machine computing. Break clean with the past.
9. Remember always that both CFI and data processing are unit record systems of accounting. All plot records should be made on an individual tree and card basis.
10. Do not take tree dimensions or descriptions on only a part of the trees. All trees in the plots are sample trees in CFI.
11. Be sure to grade the health characteristics of each tree. Grading the tree vigor assures a maximum flexibility of data processing and use.



12. Insist on a standard method of use of all instruments of measurement with special attention to the diameter tape and length measuring pole.
13. Set up a system for sort checking the mark sense, port-a-punch and 80-column data processing cards. Common factors of relationship exist for the data within and between all card fields.

#### Summary of CFI Values

CFI and data processing offer a wealth of information useful to those who wish to control the growth of their forests. Innumerable combinations of volumes by tree and forest area classes may be compiled from the records.

CFI furnishes these facts about the forest often enough to give a pleasant sense of progress or a discouraging knowledge of decline in forest condition. Supplied many times in the life of the practicing forester, instead of once or twice as in the past history of forestry, continuous forest inventory is a constant encouragement for woods betterment. CFI is not, like the one-shot cruise, a dead record of the forest, but it is only a living record if it is brought to life by frequent machine manipulation and round table analysis and discussion. Following this, the greatest value of CFI will be realized when the forest industries begin to accomplish the needed repairs to their forests. CFI offers only the blueprint for improvement. It is not the report of accomplishment.